CHAPTER VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The ion exchange process consisting of a H-form SAC resin column, 6.35 cm.(2½ in.) diameter by 120 cm. height and a OH-form SBA resin bed of the same size was capable of treating the chrome waste from an electroplating factory with high efficiency. This high quality water could cope with most effluent standards and could be disposed of with minimum environmental impacts. Moreover, the treated water could also be directly recycled as the process rinsing water, resulting in the close-circuit or non-waste system.

After the breakthrough capacity was reached, the anionic column was regenerated with sodium hydroxide solutions of different concentrations. The range of 3.5 to 15.0 per cent (by weight) concentrations was investigated in this study. It was indicated that the SBA-column sodium hydroxide regenerant of 7.5 per cent concentration was the optimum, resulting in a high peak and composite Cr VI value of eluted sodium dichromate solution. Eluted sodium dichromate solution, after passing through the SAC recovery column, would produced the reclaimed chromic acid of high concentration.

It should be noted here that no economic evalution was made in this process because the size of the column used throughout this study was comparatively small and the data obtained were not sufficient to be used as a reliable tool to make any judgement on economic grounds on this process.

Based on the results of this study, the following conclustions can be made:

1. The use of ion exchange system for treating chrome wastewater is possible. The chromium content in the treated water ranging from as low as the trace amount to 0.18 mg./cu.dm. Cr VI could be obtained from the influent of 100 mg./cu.dm. Cr VI concentration.

2. The treated water volume at breakthrough point of the ion exchange system was ranging from 150 to 300 BV/cycle.

3. The optimum concentration of sodium hydroxide regenerant for SBA resin column was 7.5 per cent by weight which was equivalent to the regeneration level of 162.5 gm. NaOH/cu.dm.resin when 4.0 cu.dm. of regenerant was used.

4. The peak and composite Cr VI values of eluted sodium dichromate solution, obtained from the SBA column regeneration at 7.5 per cent sodium hydroxide solution, were 22,422 and 5,938 mg. per cu.dm. Cr VI, respectively.

5. The upflow regeneration flowrate of 4.5 BV/hr. was found to be the most effective flowrate.

6. The highest concentration of the recovered chromic acid obtained, was 7,688 mg./cu.dm. Cr VI with an acidity of 19,435 mg. per cu.dm. as $CaCo_3$.

7. The higher the regeneration level of SBA resin column was, the less volume of recovered chromic acid would be obtained. This is because of the competing effect of sodium concentration, in other forms than the sodium dichromate, on the breakthrough capacity of recovery SAC resins.

8. Higher concentration of the recovered chromic acid could be achieved by

- seperating and passing only the concentrated portion of eluted sodium dichromate through the SAC recovery column

- using larger recovery column in order to eliminate the dilution effect caused by the remaining rinse water in the column itself.

Based on the conclusions indicated above, the following recommendations have been identified for future studies:

1. Study on the performance of the ion exchange system and the recovery of chromic acid on real wastewater from electroplating factory is recommended. It is advisable that filter should be provided ahead of the ion exchange system to remove turbidity and suspended solids from wastewater before sending to the ion exchange system.

2. Counter-current or upflow regeneration was used for the regeneration of ion exchange columns throughout this study. It caused an imcomplete regeneration when the specific gravity of sodium hydroxide regenerant was equal or more than that of SBA

resins. A study of chromic acid reclamation using co-current or downflow regeneration is recommended so that the problem of expansion and dispersion of resin bed could be eliminated. However, it must be noted here that column damage due to swelling of resin during regeneration must be taken into consideration.

3. Comparative study of chromic acid reclamation at different flowrate and SAC column regeneration condition is recommended.

4. In this study, the exhausted SAC column was regenerated with hydrochloric acid. This process will result in a release of the chloride salt of heavy metal which must be disposed away. It is advisable to have a study on the disposal of heavy metal containing in spent regenerant solution of SAC column.

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